

Effect of compliance with food safety standards on soil fertility in smallholder french bean farms in Kirinyaga County

Mnyambo, Clarice Gombe

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Abstract:

Compliance with Food Safety Standards (FSS) for production of export vegetables involves application of manure, agro-chemicals and other inputs which influence soil quality. A study was conducted in Kirinyaga County, Central Kenya to investigate the effect of compliance with FSS for production of French beans on soil quality in smallholder farms. The study area was divided into three agro-ecological zones; upper (Gichugu), middle (Ndia) and lower (Mwea) zones. Soil samples were collected from farmers in the three zones based on compliance levels: compliant with FSS, non-compliant with FSS and non-French bean growers. Compliance with FSS was following the guidelines stipulated in the GlobalGAP for production of French beans. Surface soil (0-30cm) samples were collected from 230 farms, of which 76 were compliant, 87 non-compliant and 67 non-French bean growers. To assess soil quality, samples were subjected to analysis of selected chemical properties in the laboratory. The data were analyzed using GenStat 13th Edition at 5% level of significance. In all three zones, French beans are grown in intensive mixed farming systems, and frequently as intercrop in 0.16- 0.18 hectares of land. The main organic fertilizer applied is cattle manure at the rates of 6.25 to 9.3 t/ha. The main inorganic fertilizers applied are DAP during planting and CAN as top dressing; at the rates ranging from 110 to 170 t/ha, and 135 to 150 t/ha respectively. Both organic and inorganic fertilizers are applied below recommended rates. Chemical analysis results show that soil pH for Gichugu and Ndia is strongly acid (5.35-5.51), while for Mwea it is medium acid (5.83-5.97), but not significantly different among compliance levels. In all three zones and compliance levels, carbon (1.49-1.86%) and total nitrogen (0.16-0.18%) contents were not significantly different. However, Mwea had relatively higher levels of carbon content, which can be attributed to the high amounts of manure applied compared to Gichugu and Ndia. Phosphorus and potassium contents were medium to high, but not significantly different among zones and compliance levels. Mwea had the highest content of soil P and potassium due to application of relatively higher amounts of DAP, NPK and manure. Calcium content in the soil was medium whereas magnesium content was high in all the zones and compliance levels as a result of continuous use of manure. In Mwea, the high levels can be attributed to parent material of the soil in addition to manure application. Low nitrogen levels in the soil can be attributed to continuous cultivation of crops, high uptake of N due to frequency of growth, crop harvest removal and application of N fertilizers below recommended levels. Compliant farms had higher levels of copper, iron and manganese in the soil. French bean farmers complying with FSS apply foliar sprays to supply micro nutrients to the crop. Micronutrients uptake from the soil is low thus most of the micronutrient needed by the plant is supplied through foliar feeds. This results to micronutrients level in the soil being high. The results show that compliance with FSS had no significant effect

on soil quality within the current farming and management systems. This would be explained by the prevalent practice of random crop rotations, intercropping and application of varying amounts of both organic and inorganic fertilizers. It is recommended that farmers adopt defined cropping calendars, rotations and intercrops, and also increase fertilizer amounts (CAN, NPK and manure) to recommended rates based on nutrient levels in soil and intensity of cropping for each agro-ecological zone.